RTO-West Connection Standard

Definitions
(2000-Dec-01; Draft#001)

Term	Definition
Active Power	The component of total volt-amperes in an electric circuit where the voltage and current are in phase. It is also called Real Power and is measured in watts (W), kW or MW. This is the electrical power associated with useful energy, including mechanical work and heat. Active Power used or transmitted over time is measured in watt-hours (Wh), kWh or MWh.
Ancillary Services	The term used by FERC to describe the special services that must be exchanged among generation resources, load customers and transmission providers to operate the system in a reliable fashion and allow separation of generation, transmission and Distribution functions. These include 1) scheduling, system control and dispatch, 2) reactive supply and voltage control from generators, 3) regulation and frequency response, 4) energy imbalance, 5) spinning reserves, and 6) supplemental reserves. Most of these services are included in a similar set by NERC and termed Interconnected Operations Services, which also include load following and black start capability. *WSCC Definition of Ancillary Services: Interconnected Operations Services identified by the U.S. Federal Energy Regulatory Commission (Order No. 888 issued April 24, 1996) as necessary to effect a transfer of electricity between purchasing and selling entities and which a transmission provider must include in an open access transmission tariff.*
Area Control Error (ACE)	ACE is the instantaneous difference between net actual and scheduled interchange, taking into account the effects of frequency bias including a correction for meter error.
Area Separations	Disconnection of a load area by protective relay or operator actions. All or part of the disconnected area may be blacked out.
Automatic Generation Control (AGC) System	A system that measures and sums the instantaneous flows at Interchange Points (boundaries with adjacent Load Control Area) and then adjusts generation to maintain a preset schedule of flows. It consists of continuous, Real Time load signals (MW), telemetered to AGC computers at a transmission control center. NERC Definition: Equipment which automatically adjusts a Load Control Area's generation from a central location to maintain its interchange schedule plus frequency bias
Automatic Voltage Regulator (AVR)	A system that maintains the output terminal voltage of a generator unit to an operator assigned set point.
Baud Rate	A unit of signaling speed equal to the number of discrete conditions or signal events per second, or the reciprocal of the time of the shortest signal element in a character.
Bi-directional Metering	Measures MWh and MVarh flowing in both directions ('in' and 'out' MWh and leading and lagging reactive).
Blackstart Capability	The ability of a generating plant to start its unit(s) with no external source of electric power. (WSCC)
Bottleneck	A location in the transmission system where line or equipment ratings limit transfer

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	capabilities. These situations may require special operating practices to avoid overloads under certain system conditions.
CAO	Control Area Operator: The entity responsible for the safe and reliable operation of all equipment connected to the RTO-West IES within the defined boundaries of the Control Area.
Cascading	The uncontrolled successive loss of system elements in which the loss of each successive element is contingent upon prior losses of elements.
CE	Connecting Entity: Any entity connecting generation, lines or loads to the RTOW IES.
Cogeneration Facility	Any facility that sequentially produces electricity, steam or forms useful energy (e.g., heat) from the same fuel source and which are used for industrial, commercial, heating, or cooling purposes.
Contingency	Automatic disconnection (momentary or permanent) or emergency manual disconnection of a transmission facility, load, or generator.
Control Area or Load Control Area	A system capable of regulating generation to maintain interchange schedule(s) with other systems and contributing its frequency bias obligation to the interconnection. (See Load Control Area, ACE and AGC)
Demand	The rate at which energy is being used by a customer. (NERC)
Directional Relay	A relay that responds to the relative phase position of a current with respect to another current or voltage reference.
Disconnect Switch	A three-pole switch that gives a visual opening in a three phase electrical circuit and is used for isolating equipment for safety clearances.
Distribution	The lower voltage lines and equipment directly serving electrical consumers. This is generally a radial circuit, operating at voltages below 50 kV. The term 'Distribution' may also be used to refer to equipment operating below 50 kV.
Disturbance	An unplanned event that produces an abnormal system condition. (WSCC)
Dynamic Schedule	A telemetered reading or value that is updated in Real Time and used as a schedule in the Automatic Generation Control and Area Control Error equation (AGC/ACE). The integrated value is treated as a schedule for interchange accounting purposes. Commonly used for 'scheduling' jointly owned generation to or from another Control Area.
Dynamic Scheduling Service	Provides the metering, telemetering, computer software, hardware, telecommunications, engineering, and administration required to electronically move a transmission customer's generation or demand out of the Control Area to which it is physically connected and into a different Control Area.
Dynamic Signal	A telemetered reading or value updated in Real Time used either as a tie line flow or as a schedule in the AGC/ACE equation (depending on the particular circumstances). Common applications of Dynamic Signals include 'scheduling' jointly owned generation to or from another Control Area and to move Control Area boundaries. Another application provides for an entity to request (schedule) a change in power flow. The resulting response is telemetered to the entity signifying the actual movement of a resource. This form of Dynamic Signal is applied to supplemental Control Area services. The integrated value of this signal is used for interchange accounting purposes, as appropriate.
Eccentric (Non-	Any cyclic load with the ability to change periodically by more than 50MW at a rate

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Conforming) Loads	of greater than 50MW per minute, regardless of the duration of this change.
Effectively Grounded	A system that provides an $X_0/X_1<3$ & $R_0/X_1<1$ where X_0 and R_0 are zero sequence reactance and resistance respectively, and X_1 is positive sequence reactance.
Energy Management System (EMS)	The control system master computer(s) that tie(s) several subsystems together for one man-machine interface. The subsystems include ACE, SCADA, scheduling, etc.
Fault	A short circuit on an electrical transmission or Distribution system between phases or between phase(s) and ground characterized by high currents and low voltages.
Feeder	A radial electrical circuit, generally operating below 50 kV serving one or more customers.
FERC	Federal Energy Regulatory Commission or its successor.
Ferroresonance	A phenomenon usually characterized by overvoltages and very irregular voltage and current wave shapes and associated with the excitation of one or more saturable inductors through capacitance in series with the inductor (IEEE). A condition of sustained waveform distortion and overvoltages created when a relatively weak source of voltage energizes the combination of capacitance and saturable transformers. A sufficient amount of damping, or resistance, in the circuit usually controls or eliminates the phenomenon.
Generating Facility (GF)	All or part of Requestor's electrical generator(s) or inverter(s) together with all protective, safety, and associated equipment and improvements necessary to produce electric power at Requestor's facility, including, but not limited to the Disconnect Switch, as defined herein. A GF shall be understood to include any Qualifying Facility (QF).
Hybrid Switching	A variation of single-pole switching that is used on long lines to extinguish the secondary arc of single line-to-ground faults. The faulted phase is detected and opened first via single-pole relaying. After approximately 833 milliseconds the two unfaulted phases are opened to extinguish the secondary arc. Three-phase automatic reclosing follows.
IEEE	Institute of Electrical and Electronic Engineers or its successor.
IES	Integrated Electric System
Inadvertent Flow	Power flows resulting from inadvertent interchange.
Inadvertent Interchange	The net actual interchange minus the net scheduled interchange for a specific time period.
Interchange Metering	Metering at Interchange Points between two controlling utilities. Consists of AGC (continuous MW) telemetering and hourly MWh (on-the-hour hourly load MWh). These quantities must go to both controlling utilities so they can manage their respective Load Control Areas.
Interchange Point	Locations where power flows from one Load Control Area to another (i.e. connection between two controlling utilities).
Interregional Separation	Separation of a Region from the rest of the interconnected system.
Intertie	A line or lines and related substations that provide an interconnection between Regions.
Island	A portion of the interconnected WSCC system that has become isolated due to the

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	tripping of transmission system elements. 'Local' Island - A portion of the transmission system, often a single line that is isolated from the main system and energized by a local generator.
ISO	Independent System Operator. ISO generally refers to transmission networks.
Line Drop Compensator (LDC)	An LDC is a generator excitation system supplementary control that compensates for part, or all, of the voltage drop through the unit step-up transformer and perhaps also compensates for part of the voltage drop along the radial line connecting the generator to the rest of the system.
Load Control Area	An electrical transmission Region or area that is defined where the responsible owner or operator is required to balance internal load with generation. This is accomplished by increasing or decreasing generation to maintain a prearranged schedule of flows at the interconnections to other Load Control Areas. *WSCC Definition: A system which regulates its generation in order to maintain its interchange schedule with other Load Control Areas and contributes its frequency bias obligation to the interconnection.* (See ACE and AGC)
Loop Flow	The difference between the scheduled and actual power flow, assuming zero inadvertent interchange, on an interconnection between Control Areas. Also called parallel flow.
Major Load Area	A major population or industrial center with a large load and strong integrating transmission facilities.
Minimum Protective Devices, Relays, and Interconnection Requirements	The minimum required protective relaying and/or safety devices or requirements specified in this document for the purpose of protecting RTO-West's facilities from damage or disruptions caused by a Fault, malfunction or improper operation of the Requestor's facility. Minimum Protective Relaying and Interconnection Requirements shall not be construed to include additional relaying, protective or safety devices as may be required by industry, government codes, standards, equipment manufacturing and prudent engineering design and practice to fully protect the Requestor's facilities; such shall be the sole responsibility of the Requestor.
MPO	Maximum Power Output: This is the maximum possible output from the generator under ideal conditions. For hydro units this is usually at maximum head with the wicket gates fully open.
MWh System (Megawatt Hour System)	Provides Interchange Point hourly data each hour (as compared to RMS system that reports hourly load data each day) into RTO-West. The MWh System provides bi-directional MWh and bi-directional reactive. MWh data is used to verify hourly schedules.
System Impact Study	A study performed by RTO-West as defined by FERC Order 888
NERC	North American Electric Reliability Council or its successor. NERC is a not-for-profit company formed by the electric utility industry in 1968 to promote the reliability of the electricity supply in North America. NERC consists of ten Regional Reliability Councils, one of which is the Western Systems Coordinating Council.
Non-Spinning Reserve	That portion of the Operating Reserve capable of being connected to the bus and loaded within ten minutes. Also included is any load, which is designated for use as reserve and can be reduced by transmission operator action within ten minutes.

Term	Definition
	(WSCC)
NWPP	Northwest Power Pool or its successor.
OASIS	Open Access Same-Time Information System is an electronic posting system for transmission access data that allows all Transmission Customers to view the data simultaneously as specified by FERC Order 889 and modified by subsequent FERC orders.
Operating Reserve	That reserve above firm system load capable of providing for regulation within the hour to cover load variations and power supply reductions. It consists of spinning reserve and Non-Spinning Reserve. (WSCC) The *NERC Definition: Provides additional capacity from electricity generators that are on line, loaded to less than their maximum output, and available to serve customer Demand immediately should a Contingency occur.*
Operational Transfer Capability	The Rated Transfer Capability less reductions caused by, but not limited to, physical limitations such as line or equipment outages, stability limits, or Loop Flow.
OSHA	Occupational Safety and Health Administration or its successor.
Phase Unbalance	The percent deviation of voltage or current in one phase as compared to the average of all three phases.
Pilot Protection	A form of line protection that uses a communication channel as a means to compare electrical conditions at the terminals of a line. (IEEE) The communication channel may be power line carrier, microwave or other radio, fiber optics, leased telephone line or a dedicated hardwire circuit.
Point of Connection	The location on the RTO-West Transmission System where a new connection is established to serve a load, generation or connect a line to another electrical system.
Point of Delivery or Receipt	Point, for contractual and accounting purposes, where electric systems connect with the primary purpose of one-way power delivery.
Point(s) of Interconnection	Point at which utility systems are connected at which power can flow in either direction for power delivery, resource integration, and system reliability improvement. The physical location(s) where RTO-West's transmission line conductors are connected to Requestor's conductors to allow operation of Requestor's facility with RTO-West's Transmission System.
Power Factor	The ratio of Real Power in watts to the product of volts times amperes in an alternating current circuit. The Power Factor is unity when the voltage and current are in phase. See Reactive Power.
Power System	The integrated electrical generation and transmission facilities owned or controlled by one electric utility organization. (WSCC)
Project Requirements Diagram (PRD)	A graphical tool (drawing) which is used to describe a project plan before it is attempted. The diagram is made to illustrate the scope and plan of service of any given project, to include major power system features, the power system equipment and the ancillary service equipment which will operate and protect it. Some equipment requires communication services to interconnect it with distant resources to complete the protection and control services. Expected environmental and power system stresses, derived from studies of detailed computer models of the power system, are noted to provide reviewers and designers with a "maximum operating condition" scenario. This determines ratings required of equipment to be

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	selected. All of this information establishes the requirements. The PRD is circulated among the engineering, operating and field staff to gather a peer review, identifying correct and complete application of the chosen technologies, to produce the plan of service. PRD's are complete enough that guideline , budgetary estimates can be produced from them. When the review is complete and all questions answered, the PRD can be issued as a final plan of service. Upon acceptance of that plan, and provision of funding, based on the estimates produced, the PRD becomes the initial guide for design, along with any additional contract stipulations.
Prudent Electric Utility Practices or 'Prudent Utility Practice'	The generally accepted design, practices, methods, operation and maintenance of a Power System, to achieve safety, dependability, efficiency, and economy, and to meet utility and industry codes, standards, and regulations.
Pseudo-Tie	A telemetered reading or value that is updated in Real Time and used as a tie line flow in the AGC/ACE equation but for which no physical Intertie or energy metering actually exists. It usually represents a portion of an actual metered flow. The integrated value is used as a metered megawatt-hour (MWh) value for interchange accounting purposes. A Pseudo-Tie is one form of Dynamic Signal.
Qualifying Facility (QF)	Any Cogeneration or Small Power Production Facility that meets the criteria for size, fuel use, efficiency, and ownership as promulgated in 18 CFR, Chapter I, Part 292, Subpart B of the Federal Energy Regulatory Commission's Regulations.
Radial Line	A transmission line that is connected to the transmission network only at one end. More typically, a Distribution line where only one end connects back to the network and loads are served at the other end and along the line.
Rated Field Current	This is the field current required to produce rated terminal voltage at the generator's rated MVA and rated over-excited power factor.
Reactive Power	The component of total volt-amperes in an alternating current circuit where the voltage and current are out of phase by ninety electrical degrees. It is measured in units of volt-amperes reactive (Var), kVar or MVar. It represents the power involved in the alternating exchange of stored energy in inductive and capacitive electromagnetic fields. Although this type of power supplies no useful energy, it is an inherent requirement for all alternating current Power Systems. Reactive Power transferred over time is measured in Var-hours (Varh). See Power Factor.
Real Power	The component of total volt-amperes in an electric circuit where the voltage and current are in phase. It is also called Active Power and is measured in watts (W), kW or MW. This is the electrical power associated with useful energy, including mechanical work and heat. Real Power used or transmitted over time is measured in kilowatt-hours (kWh) or megawatt-hours (MWh).
Real Time	Data (such as instantaneous watts) reported as it happens. The reporting (update) intervals are no longer than a few seconds. Applies to AGC type data, but not to RMS data, which is accumulated and reported only when queried by a master station. Interchange MWh data may be accumulated at the meter or at SOCC in the EMS.
Region	A portion of the WSCC system, such as Northern California or the Northwest that

Term	Definition
	operates as an interchange area.
Remedial Action	Special pre-planned corrective measures that are initiated following a disturbance to provide for acceptable system performance. (WSCC) These actions can either be manual or automatic.
Remedial Action Scheme (RAS)	A protection system that automatically initiates one or more control actions following electrical disturbances. Also called 'Special Protection System.' (WSCC) Typical automatic remedial actions include generator tripping or equivalent reduction of energy input to the system, controlled tripping of interruptible load, DC line ramping, insertion of braking resistors, insertion of series capacitors and controlled opening of interconnections and/or other lines including system islanding. Typical manual remedial actions include manual tripping of load, tripping of generation, etc.
Requestor	An electrical utility or other customer or their representative that is requesting a new connection to the RTO-West Transmission System.
Revenue Metering	General term for metering calibrated to ANSI Standards for billing accuracy.
Revenue Metering System (RMS)	Provides hourly data daily. A meter and recording device is installed at points where billing quality data is required. The device meters MW and MVar (bi-directional for Points of Interconnection) and records MWh and MVarh data on an hourly basis. It can also be forced to poll a remote at any time through dial-in-terminal ports available to RTO-West personnel.
Single Contingency Rating	The capability, determined in accordance with WSCC criteria and as mutually agreed by the parties, of a transmission line or system to transfer a specified amount of electric power in a direction, with all major facilities initially in-service, such that following loss of any one major facility, the transfers may be continued in a reliable and safe manner while allowing the operators sufficient time to adjust the system to prepare for a further Contingency.
Small Power Production Facility	A facility that uses primarily biomass, waste or renewable resources, including wind, solar, and water to produce electric power.
Static Var Compensator (SVC)	A device consisting of thyristor-switched or thyristor-controlled shunt reactors, and perhaps also thyristor-switched shunt capacitors that is used for fast control of system voltages sometimes on an individual phase basis.
Supervisory Control and Data Acquisition (SCADA)	A computer system that allows secure remote control of equipment and the acquisition of information such as alarms, status of equipment and analog quantities at a remote site.
TFO	Transmission Facility Owner: The owner of the transmission facilities to which the CE is connecting.
Transfer Capability	The maximum capability of a transmission line or system to transfer electric power in a reliable, stable and safe manner as mutually determined and consistent with safe utility practice.
Transmission Maintenance and Inspection Plan	A procedure that describes when, what and how maintenance is to be accomplished.

Term	Definition
(TMIP)	
WCB	Workers' Compensation Board of British Columbia. The British Columbia entity that sets workplace health and safety standards.